

AMENDMENTS TO THE DRAWINGS

The attached sheets of drawings are submitted as replacement formal drawings.

REMARKS

Claims 1-19 are pending in the application. Claims 13-19 have been added by this amendment. No claims are presently allowed.

The claims are amended to correct the use of "a" and "the"; to cancel "of low optical loss"; to cancel references to "steps"; to cancel "precursor"; to cancel "dynamically"; to clarify that "open system" is "open distillation system";

Claims 1 and 11 are amended to recite "sealing the open distillation system." Support for this amendment is found at page 11, lines 10-11.

Claims 1, 4 are amended to add "reacting" with the homogenizing. Support for this amendment is found in original claim 9.

Claims 3, 4, 5 are amended to clarify that the arsenic monochalcogenide and the at least one chalcogenide are distilled, deposited, reacted, and/or homogenized.

Claim 5 is amended to cancel the redundant recitation of vacuum distillation and to cancel "about."

Claims 6 and 7 are amended to clarify that the components of the arsenic monochalcogenide are arsenic and the chalcogenide of the arsenic monochalcogenide.

Claims 8 and 9 are amended to clarify that an unpurified arsenic monochalcogenide is distilled.

Claim 9 is amended to recite a numerical distillation rate. Support is found at page 9, lines 9-10.

Claim 10 is amended to clarify that the glass receptacle is the hot section and the cold section.

Claim 11 is amended to clarify that the distilling produces distilled arsenic monosulfide and sulfur, which is then reacted and homogenized.

Claim 12 is amended to recite that the arsenic sulfide glass has uniform color. Support for this amendment is found at page 11, line 17.

New claims 13-19 were inadvertently omitted from the application as filed (as well as the final part of claim 12).

Claims 13 and 14 are supported at page 11, line 1.

Claim 15 is supported at page 11, lines 15-17.

Claims 16 and 17 are supported at page 8, lines 18-19.

Claim 18 is supported by claim 1.

Claim 19 is supported at page 5, line 21 and page 7, line 2.

No new matter has been added.

In order to improve readability, a clean version of the claims is included in these remarks.

Claim Rejections – 35 U.S.C. § 112

Claims 1-10 and 12 have been rejected under 35 U.S.C. § 112, second paragraph as being allegedly indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

Claim 1 recited “an open distillation system” and “an open system.” The latter has been changed to “the open distillation system” throughout the claims.

Claim 6 recited “components of the chalcogenide precursor” and claim 7 recited “precursor components.” These have been changed to “the arsenic and the chalcogenide of the arsenic monochalcogenide.”

Claims 8-10 recited “chalcogenide precursor.” This has been changed to “unpurified arsenic monochalcogenide” or canceled.

Claim 9 recited “the precursor.” This has been canceled.

Claim 12 recited “the resulting.” This is because the rest of the claim was on a missing page not filed with the application. The has been reworded. The claim also purportedly limited the chalcogenide to sulfur. The claim dependency has been corrected to claim 1 to provide antecedent basis for sulfur.

Claim Rejections – 35 U.S.C. § 103

Claims 1-7 and 12 have been rejected under 35 U.S.C § 103(a) as being allegedly unpatentable over Upton (US 3,209,641 and US 2,804,378) in view of Churbanov et al. (*J. Optoelect. and Adv. Mat.*, 3(2), 341-349 (2001)).

In order to make a *prima facie* case of obviousness, each claim limitation must be disclosed in the references (MPEP 2143.03). Among other deficiencies, none of the references discloses the limitation in claim 1 of distilling the arsenic monochalcogenide and at least one chalcogenide under vacuum in an open distillation system. Both Upton references show that the distillation occurs in a closed system (Fig. 8 of '378 and Fig. 2 of '641).

Churbanov does not show distillation of the arsenic monochalcogenide and the chalcogenide in an open system. The only disclosure of an open system is in reference to purification of the reactants, not distillation of both reactants together (p. 346, last paragraph).

As all the claim limitations of claim 1 are not disclosed in the reference, a *prima facie* case of obviousness has not been made.

Claims 2-7 depend from and contain all the limitations of claim 1. The arguments regarding the lack of a *prima facie* case for claim 1 are applicable to claims 2-7. Claim 12 is now dependent on claim 11.

Further, as to claim 5, the claim recites that the distillation occurs below about 550°C. Churbanov discloses distillation at 700-800°C (p. 347, lines 2-3). The attached declaration includes absorption spectra comparing the absorbance of glass distilled below 450°C to that distilled at 750°C. The high-temperature-distilled glass shows a very large absorbance at 4 μm due to S-H bonds. This absorbance is greatly reduced in the glass distilled at 450°C. As explained in the declaration, the S-H bonds are created because arsenic monosulfide decomposes at higher temperatures, which allows it to pick up hydrogen from the walls of the distillation vessel. At lower temperatures, arsenic monosulfide does not decompose and pick up hydrogen, resulting in a more useful glass. It should also be noted that an open vacuum distillation system allows for this low temperature distillation. In a closed vacuum, once the materials begin to evaporate, the closed system is no longer under vacuum. The temperature must be raised to continue the evaporation. In the presently claimed open vacuum system, there is no build-up of evaporated materials, so distillation can continue at the lower temperature. This also applicable to other arsenic monochalcogenides.

Claims 8-11 have been rejected under 35 U.S.C § 103(a) as being allegedly unpatentable over Upton in view of Churbanov and further in view of Jerger (US 2,999,027).

As above, Jerger also does not disclose distilling the arsenic monochalcogenide and at least one chalcogenide under vacuum in an open distillation system. Fig. 1 shows that nitrogen gas is pumped into the condensation chamber so that it is neither open nor under vacuum. As all the claim limitations of claims 1 (claims 8-10 dependent thereon) and 11 are not disclosed in the reference, a *prima facie* case of obviousness has not been made.

In view of the foregoing, it is submitted that the application is now in condition for allowance.

In the event that a fee is required, please charge the fee to Deposit Account No. 50-0281, and in the event that there is a credit due, please credit Deposit Account No. 50-0281.

Respectfully submitted,



Joseph T. Grunkemeyer
Reg. No. 46,746
Phone No. 202-404-1556
Office of the Associate Counsel
(Patents), Code 1008.2
Naval Research Laboratory
4555 Overlook Ave, SW
Washington, DC 20375-5325

CLEAN VERSION OF CLAIMS

1. A process for making a chalcogenide glass comprising:
disposing an arsenic monochalcogenide and at least one chalcogenide selected from the group consisting of sulfur, selenium, tellurium and mixtures thereof, at a hot section of an open distillation system;
distilling under vacuum in the open distillation system the arsenic monochalcogenide and the at least one chalcogenide so that the arsenic monochalcogenide and the at least one chalcogenide are deposited at a cold section of the open distillation system;
sealing the open distillation system; and
reacting and homogenizing the distilled arsenic monochalcogenide and the at least one chalcogenide while a transformation from crystalline state to glassy state takes place.
2. The process of claim 1 wherein the open distillation system is an elongated glass receptacle with an open end adjacent the cold section.
3. The process of claim 1 wherein the distilling of the arsenic monochalcogenide and the at least one chalcogenide comprises depositing arsenic monochalcogenide precursor and at least one chalcogenide in solid form at the cold section of the open distillation system.
4. The process of claim 3 wherein the reacting and homogenizing of the arsenic monochalcogenide and the at least one chalcogenide is conducted at a temperature above 550°C whereby the chalcogenide glass is formed.
5. The process of claim 1 wherein the distilling of the arsenic monochalcogenide and the at least one chalcogenide is carried out at a temperature below 550°C.
6. The process of claim 1, further comprising:
reacting arsenic and the chalcogenide of the arsenic monochalcogenide to form the arsenic monochalcogenide.

7. The process of claim 6 wherein the reacting of the arsenic and the chalcogenide of the arsenic monochalcogenide is carried out at a temperature of 300°C to 450°C.
8. The process of claim 1, further comprising:
distilling an unpurified arsenic monochalcogenide in an open glass receptacle to form the arsenic monochalcogenide; and
homogenizing the arsenic monochalcogenide.
9. The process of claim 8 wherein the distilling of the unpurified arsenic monochalcogenide is carried out at a distillation rate of at least about $65.6 \times 10^{-3} \text{ g/cm}^2\text{-sec}$.
10. The process of claim 1 wherein the hot section and the cold section comprise glass.
11. A process for making arsenic sulfide glass comprising:
placing arsenic monosulfide in a glass receptacle;
distilling under vacuum the arsenic monosulfide to make purified arsenic monosulfide;
homogenizing the purified arsenic monosulfide;
adding sulfur to the purified arsenic monosulfide;
distilling under vacuum in an open distillation system the purified arsenic monosulfide with the sulfur to form distilled arsenic monosulfide and sulfur;
sealing the open distillation system; and
reacting and homogenizing the distilled arsenic monosulfide and sulfur to form the arsenic sulfide glass.
12. The process of claim 11;
wherein the distilling of the arsenic monosulfide and the sulfur is carried out at a distillation rate of $500\text{-}1500 \times 10^{-3} \text{ g/cm}^2\text{-sec}$; and
wherein the reacting and homogenizing of the distilled arsenic monosulfide and sulfur results in the arsenic sulfide glass having uniform color.
13. The process of claim 12 wherein the distilling of the arsenic monosulfide and the sulfur is carried out at a distillation rate of about above $900 \times 10^{-3} \text{ g/cm}^2\text{-sec}$.

14. The process of claim 1 wherein the distilling of the arsenic monochalcogenide and the at least one chalcogenide is carried out at a distillation rate in excess of about $900 \times 10^{-3} \text{ g/cm}^2\text{-sec}$.
15. The process of claim 12 wherein the reacting and homogenizing of the distilled arsenic monosulfide and sulfur is carried out by heating the distilled arsenic monosulfide and sulfur at a temperature above about 450°C until the color of the arsenic sulfide glass becomes uniform.
16. The process of claim 12, further comprising:
reacting arsenic and sulfur to form arsenic monosulfide.
17. The process of claim 16 wherein the reacting of arsenic and sulfur is carried out at a mperature of about 350°C to about 450°C until arsenic monosulfide is formed.
18. The arsenic chalcogenide glass prepared by the process of claim 1.
19. The arsenic sulfide glass prepared by the process of claim 13;
wherein the molar concentration of arsenic and sulfur varies from As_7S_{93} to $\text{As}_{40}\text{S}_{60}$; and
wherein the optical loss of the arsenic sulfide glass is about 30 dB/km or lower.